Hardware requirements and architecture

**I/O requirements and pin assignments**

Inputs –

* Four Strain gauge sensors on the beam connected in a full bridge configuration 🡪 analogue signal 🡪 can use A/D converter to change it into a 10 bit number i.e. 1024 values
* From the serial ports (the keyboard)
* Keypad connected via pins
* When in FACTORY or USER\_REMOTE mode
  + commanded by a terminal via an RS232 port
  + commands shall be entered from the keyboard
  + output 🡪 display on the terminal screen
* Set of commands are given from the assignment sheet for certain functionalities within a particular mode 🡪 page 8 and 9

Outputs

* Output interface 🡪 to display command prompts, status and error messages and weight data
  + Visual 🡪 operate whenever the instrument is on
    - Uses a 16 character by 2 line LCD module
    - Can use LED display to enhance visual display if necessary
    - Serial output to terminal
  + Auditory
    - Text to speech processor
    - Additional auditory interface such as tones can be added to enhance interface
    - Can control to mute the auditory interface
* USER\_REMOTE mode
  + Continuous display of load readings

**Equipment provided**

Microcontroller circuit

* MNML PIC 18 board which implements a minimal PIC18F452 system which contains:
  + +5V 200mA power supply
  + PIC18F452 microcontroller and block
  + In circuit programming/debugging port
  + ES 232 driver and D9 port
  + Single LED on PORT B
* I/O devices
  + Strain gauged cantilever beam and amplifier
  + Text to speech processor board and speaker
  + LCD module
  + Alphanumeric keypad

**Pin Assignment**

PORT A

* RA0 – used for signal from the strain gauge bridge output 🡪 receive the analog signal from the strain gauge sensor and this signal will eventually go through a A/D conversion
* RA1-7– used for signal input to the speech board???

PORT B

* RB0-2 – used for the keypad columns
  + Interrupt driven when keypad is pressed
  + To correspond with PORTC to figure out which key is pressed
* RB4 – controls LED to enrich visual interface in some way –yet be determined

PORT C

* RC1,3-5
  + used for keypad rows
  + used in conjunction with the PORTB pins allocated for keypad columns
  + when within the interrupt cross reference with PORT B to figure which key was pressed
* RC6 – used for USART transmission of text
* RC7 – used for USART receive input from keyboard

PORT D

* RD 0-7 🡪 required for the LCD module 8 data bits

PORT E

* RE 0-2
  + for the LCD control lines
  + Read/Write + Register Select signal + operation enable

**Connections, termination and enclosure**

* Possible usage of ribbon cables to reduce wires being tangled up and hence reduce clutter and wires connections from crossing over 🡪 pin connections or soldered on
* Connections to strain gauge sensors 🡪 pins and clips can be used for easy removal
  + Could be possible to solder on at the end for permanent connection but for testing purposes, simple pin connections will suffice
* the entire hardware items from the scale, LCD, microchip board and keypad can be all integrated within a box where:
  + scale is positioned on the side extruding from the box
  + LCD and Keypad mounted on top of the box
  + Speakers mounted on top as well
  + Microchip carefully nested from within the box
  + If LED from PORTB is used in some way 🡪 can output in a bigger LED if necessary

**Possible top view of the enclosure**

S

C

A

L

E

LCD

Keypad

**Power Supply**

* as stated within the design specifications of the computer controlled scales:
  + logic and interfacing circuits may be powered by +5V and +/- 12V DC
  + these can be obtained from the bench power supply
  + extension 🡪 may be powered by +9V DC only 🡪 from a single alkaline battery